

WE CLAIM:

1. A structure for metallurgical connections between metal
wires and bond pads positioned on integrated circuits
5 having copper interconnecting metallization,
comprising:

a bond pad surface of non-oxidized copper;

a layer of barrier metal that resists copper
diffusion deposited on said copper surface, said
10 barrier metal and the thickness thereof
coordinated such that said layer reduces the
diffusion of copper at 250 °C by more than 80 %
compared with the absence of said barrier metal;

an outermost layer of bondable metal, coordinated
15 with the thickness thereof such that said
outermost layer reduces the diffusion of said
barrier metal at 250 °C by more than 80 %
compared with the absence of said bondable metal;
and

20 one of said metal wires bonded to said outermost
bondable metal.

2. The structure according to Claim 1 wherein said barrier
metal layer is selected from a group consisting of
nickel, cobalt, chromium, molybdenum, titanium,
25 tungsten, and alloys thereof.

3. The structure according to Claim 1 wherein said
bondable metal layer is selected from a group
consisting of gold, platinum, palladium, and silver.

4. The structure according to Claim 1 further comprising
30 a thin seed metal layer between said non-oxidized
copper and said barrier metal layer.

5. The structure according to Claim 4 wherein said seed

metal is palladium or tin.

6. The structure according to Claim 1 wherein said metal wires are selected from a group consisting of gold, copper, aluminum, and alloys thereof.

5 7. A method for forming metallurgical connections between metal wires and bond pads positioned on integrated circuits having copper interconnecting metallization, comprising:

activating the surface of said copper metallization

10 of said bond pads, depositing seed metal;

plating a layer of barrier metal that resists copper

diffusion, by electroless deposition, said

barrier metal and the thickness thereof

coordinated such that said layer reduces the

15 diffusion of copper at 250 °C by more than 80 %

compared with the absence of said barrier metal;

plating a layer of a bondable metal, by electroless

deposition, said bondable metal and the thickness

thereof coordinated such that said layer reduces

20 the diffusion of said barrier metal at 250 °C by

more than 80 % compared with the absence of said

bondable metal, thereby forming the outermost

bondable metal layer of said bond pad; and

25 bonding one of said metal wires onto said outermost

metal.

8. The method according to Claim 7 wherein said wire bonding step comprises ball bonding or wedge bonding.

9. The method according to Claim 7 wherein said bond pads are formed by a process comprising:

30 depositing a protective overcoat over the surface of

said integrated circuit, including the surface

portions having copper metallization; and

opening selected areas of said overcoat by photolithographic techniques, exposing the surface of said copper metallization.

10. The method according to Claim 9 further comprising a
5 cleaning step after said opening step, by immersing said exposed copper surface in a solution of sulfuric acid, nitric acid, or any other acid.

11. The method according to Claim 7 wherein said step of activating comprises immersing the bond pads in a
10 catalytic metal chloride solution.

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12. ~~The method according to Claim 11 wherein said metal chloride is palladium chloride, depositing palladium seeds.~~

13. The method according to Claim 7 wherein said
15 electroless plating of said bondable metal layer is immersion plating.

14. The method according to Claim 7 wherein said electroless plating of said bondable metal layer is immersion plating followed by autocatalytic plating.

20 15. The method according to Claim 7 further comprising the step of electrically probing said outermost metal of said bond pad before the step of bonding, leaving substantially no probe marks.

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